AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) An apparatus for providing an adjustment signal for positioning a transducing head in a hard disk drive (HDD), wherein the transducing head reads position information recorded in data tracks on a storage medium and produces a substantially sinusoidal position error signal (PES) having a first frequency, the apparatus comprising:

   a continuous time filter (CTF) for receiving the PES and transmitting a fundamental frequency while attenuating lower and higher frequencies of the PES to provide a filtered PES;

   an analog-to-digital converter(ADC) for sampling the filtered PES and providing a sampled PES;

   a filter for ~~attenuating~~ substantially eliminating a plurality of harmonic frequencies of the sampled PES; and

   a discrete Fourier transform (DFT) for providing an analog adjustment signal for positioning the transducing head, wherein the DFT receives the filtered samples of the PES.

2. (Original) The apparatus of claim 1, wherein the ADC samples the PES at a second frequency.

3. (Original) The apparatus of claim 2, wherein the second frequency is twice the first frequency.

4. (Original) The apparatus of claim 1, further comprising a down converter to restore the filtered samples of the PES to the first frequency.

5. (Original) The apparatus of claim 1, wherein the DFT provides the analog adjustment signal for every four samples of the filtered samples of the PES.

6. (Original) The apparatus of claim 1, wherein the CTF is an analog filter.

7. (Original) The apparatus of claim 1, wherein the filter is a bandpass filter.

8. (Original) The apparatus of claim 7, wherein the bandpass filter is an analog filter.

9. (Withdrawn) The apparatus of claim 7, wherein the bandpass filter is a digital filter.

10. (Cancelled) The apparatus of claim 9, wherein the digital bandpass filter is a finite impulse response filter.

11. (Cancelled) The apparatus of claim 9, wherein the digital bandpass filter is an infinite impulse response filter.

12. (Withdrawn) The apparatus of claim 9, wherein the digital bandpass filter has a sinusoidal impulse response.

13. (Withdrawn) The apparatus of claim 9, wherein the digital bandpass filter is a cascade filter further comprising a sinusoidal impulse filter and a simple filter.

14. (Withdrawn) The apparatus of claim 13, wherein the simple filter is a comb filter.

15. (Withdrawn) The apparatus of claim 14, wherein the comb filter comprises a cascade of a plurality of comb filters.

16. (Withdrawn) The apparatus of claim 14, wherein the comb filter has an impulse response of $[1,1,1]$.

17. (Withdrawn) The apparatus of claim 13, wherein the sinusoidal impulse filter has an impulse response substantially equal to $\left[\frac{1}{\sqrt{2}},1,\frac{1}{\sqrt{2}},0,-\frac{1}{\sqrt{2}},-1,-\frac{1}{\sqrt{2}}\right]$.

18. (Withdrawn) The apparatus of claim 13, wherein the cascade filter has an impulse response substantially equal to

$$\left[\frac{1}{\sqrt{2}},1+\frac{1}{\sqrt{2}},1+\frac{2}{\sqrt{2}},1+\frac{1}{\sqrt{2}},0,-\left(\frac{1}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right),-\left(1+\frac{2}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right)\right].$$

19. (Currently Amended) A apparatus for providing an adjustment signal for positioning a transducing head in a hard disk drive (HDD), wherein the transducing head reads position information recorded in data tracks on a storage medium and produces a substantially sinusoidal position error signal (PES) having a first frequency, the apparatus comprising:

means for filtering the PES to pass the fundamental frequency and to attenuate lower the lower and higher frequencies of the PES to provide a filtered PES;

means for sampling the filtered PES to provide a sampled PES;

means for ~~attenuating~~ substantially eliminating a plurality of harmonic frequencies of the sampled PES; and

means for receiving the filtered samples of the PES and for providing an analog adjustment signal for positioning the transducing head.

20. (Original) The apparatus of claim 19, wherein the sampling means samples the filtered PES at a second frequency.

21. (Original) The apparatus of claim 20, wherein the second frequency is twice the first frequency.

22. (Original) The apparatus of claim 20, further comprising means for restoring the filtered samples of the PES to the first frequency.

23. (Original) The apparatus of claim 19, wherein the means for providing the analog adjustment signal uses four samples of the filtered samples of the PES.

24. (Original) The apparatus of claim 19, wherein the means for filtering is an analog filtering means.

25. (Original) The apparatus of claim 19, wherein the means for attenuating harmonic frequencies is a bandpass filtering means.

26. (Original) The apparatus of claim 25, wherein the bandpass filtering means is an analog filtering means.

27. (Withdrawn) The apparatus of claim 25, wherein the bandpass filtering means is a digital filtering means.

28. (Cancelled) The apparatus of claim 27, wherein the digital bandpass filtering means is a finite impulse response filtering means.

29. (Cancelled) The apparatus of claim 27, wherein the digital bandpass filtering means is an infinite impulse response filtering means.

30. (Withdrawn) The apparatus of claim 27, wherein the digital bandpass filtering means has a sinusoidal impulse response.

31. (Withdrawn) The apparatus of claim 27, wherein the digital bandpass filtering means is a cascade filtering means further comprising a sinusoidal impulse filtering means and a simple filtering means.

32. (Withdrawn) The apparatus of claim 31, wherein the simple filtering means is a comb filtering means.

33. (Withdrawn) The apparatus of claim 32, wherein the comb filtering means comprises a cascade of a plurality of comb filtering means.

34. (Withdrawn) The apparatus of claim 32, wherein the comb filtering means has an impulse response of $[1,1,1]$.

35. (Withdrawn) The apparatus of claim 31, wherein the sinusoidal impulse filtering means has an impulse response substantially equal to $\left[\frac{1}{\sqrt{2}},1,\frac{1}{\sqrt{2}},0,-\frac{1}{\sqrt{2}},-1,-\frac{1}{\sqrt{2}}\right]$.

36. (Withdrawn) The apparatus of claim 31, wherein the cascade filtering means has an impulse response substantially equal to

$$\left[\frac{1}{\sqrt{2}},1+\frac{1}{\sqrt{2}},1+\frac{2}{\sqrt{2}},1+\frac{1}{\sqrt{2}},0,-\left(\frac{1}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right),-\left(1+\frac{2}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right)\right].$$

37. (Currently Amended) A data recording disk drive system for providing an adjustment signal for positioning a transducing head in a hard disk drive (HDD), the apparatus comprising, the system comprising:

a disk having a surface for storing data thereon;

at least one transducing head for reading position information recorded in data tracks on a storage medium and producing a substantially sinusoidal position error signal (PES) having a first frequency;

a servo actuator for positioning the at least one transducing head;

a communications channel for transmitting data to and from the at least one head;

a continuous time filter (CTF) for receiving the PES and transmitting a fundamental frequency while attenuating lower and higher frequencies of the PES to provide a filtered PES;

an analog-to-digital (ADC) converter for sampling the filtered PES producing a sampled PES;

a filter for ~~attenuating~~ substantially eliminating a plurality of harmonic frequencies of the filtered samples of the PES; and

a discrete Fourier transform (DFT) for providing an analog adjustment signal for positioning the at least one transducing head, wherein the DFT receives the filtered samples of the PES.

38. (Original) The system of claim 37, wherein the ADC samples the filtered PES at a second frequency.

39. (Original) The system of claim 38, wherein the second frequency is twice the first frequency.

40. (Original) The system of claim 38, further comprising a down converter to restore the filtered samples of the PES to the first frequency.

41. (Original) The system of claim 37, wherein the DFT provides the analog adjustment signal for every four samples of the filtered samples of the PES.

42. (Original) The system of claim 37, wherein the CTF is an analog filter.

43. (Original) The system of claim 37, wherein the filter is a bandpass filter.

44. (Original) The system of claim 43, wherein the bandpass filter is an analog filter.

45. (Withdrawn) The system of claim 43, wherein the bandpass filter is a digital filter.

46. (Cancelled) The system of claim 45, wherein the digital bandpass filter is a finite impulse response filter.

47. (Cancelled) The system of claim 45, wherein the digital bandpass filter is an infinite impulse response filter.

48. (Withdrawn) The system of claim 45, wherein the digital bandpass filter has a sinusoidal impulse response.

49. (Withdrawn) The system of claim 45, wherein the digital bandpass filter is a cascade filter further comprising a sinusoidal impulse filter and a simple filter.

50. (Withdrawn) The system of claim 49, wherein the simple filter is a comb filter.

51. (Withdrawn) The system of claim 50, wherein the comb filter comprises a cascade of a plurality of comb filters.

52. (Withdrawn) The system of claim 50, wherein the comb filter has an impulse response of $[1,1,1]$.

53. (Withdrawn) The system of claim 49, wherein the sinusoidal impulse filter has an impulse response substantially equal to $\left[\frac{1}{\sqrt{2}},1,\frac{1}{\sqrt{2}},0,-\frac{1}{\sqrt{2}},-1,-\frac{1}{\sqrt{2}}\right]$.

54. (Withdrawn) The system of claim 49, wherein the cascade filter has an impulse response substantially equal to

$$\left[\frac{1}{\sqrt{2}},1+\frac{1}{\sqrt{2}},1+\frac{2}{\sqrt{2}},1+\frac{1}{\sqrt{2}},0,-\left(\frac{1}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right),-\left(1+\frac{2}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right)\right].$$

55. (Currently Amended) A data recording disk drive system for providing an adjustment signal for positioning a transducing head in a hard disk drive (HDD), wherein the transducing head reads position error information recorded on the HDD and produces a substantially sinusoidal position error signal (PES) having a first frequency, the system comprising:

means for storing data on the rotating disk;

means for positioning the transducing head;

means for transmitting data to and from the transducing head;

means for filtering the PES to pass the fundamental frequency and to attenuate lower the lower and higher frequencies of the PES to produce a filtered PES;

means for sampling the filtered PES to produce a sampled PES;

means for ~~attenuating~~ substantially eliminating a plurality of harmonic frequencies of the sampled PES; and

means for receiving the filtered samples of the PES and for providing an analog adjustment signal for positioning the means for reading.

56. (Original) The system of claim 55, wherein the sampling means samples the PES at a second frequency.

57. (Original) The system of claim 56, wherein the second frequency is twice the first frequency.

58. (Original) The system of claim 56, further comprising means to restore the filtered samples of the PES to the first frequency.

59. (Original) The system of claim 55, wherein the means for providing the analog adjustment signal uses four samples of the sampled PES.

60. (Original) The system of claim 55, wherein the means for filtering is an analog filter.

61. (Original) The system of claim 55, wherein the means for attenuating harmonic frequencies is a bandpass filtering means.

62. (Original) The system of claim 61, wherein the bandpass filtering means is an analog filtering means.

63. (Withdrawn) The system of claim 61, wherein the bandpass filtering means is a digital filtering means.

64. (Cancelled) The system of claim 63, wherein the digital bandpass filtering means is a finite impulse response filtering means.

65. (Cancelled) The system of claim 63, wherein the digital bandpass filtering means is an infinite impulse response filtering means.

66. (Withdrawn) The system of claim 63, wherein the digital bandpass filtering means has a sinusoidal impulse response.

67. (Withdrawn) The system of claim 63, wherein the digital bandpass filtering means is a cascade filtering means further comprising a sinusoidal impulse filtering means and a simple filtering means.

68. (Withdrawn) The system of claim 67, wherein the simple filtering means is a comb filtering means.

69. (Withdrawn) The system of claim 68, wherein the comb filtering means comprises a cascade of a plurality of comb filtering means.

70. (Withdrawn) The system of claim 68, wherein the comb filtering means has an impulse response of $[1,1,1]$.

71. (Withdrawn) The system of claim 67, wherein the sinusoidal impulse filtering means has an impulse response substantially equal to $\left[\frac{1}{\sqrt{2}},1,\frac{1}{\sqrt{2}},0,-\frac{1}{\sqrt{2}},-1,-\frac{1}{\sqrt{2}}\right]$.

72. (Withdrawn) The system of claim 67, wherein the cascade filtering means has an impulse response substantially equal to

$$\left[\frac{1}{\sqrt{2}},1+\frac{1}{\sqrt{2}},1+\frac{2}{\sqrt{2}},1+\frac{1}{\sqrt{2}},0,-\left(\frac{1}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right),-\left(1+\frac{2}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right)\right].$$

73. (Currently Amended) A method for providing an adjustment signal for positioning a transducing head in a hard disk drive (HDD), wherein the transducing head reads position information recorded in data tracks on a storage medium and produces a substantially sinusoidal position error signal (PES) having a first frequency, the method comprising:

(a) reading position information recorded in data tracks on the rotating disk;

(b) producing a sinusoidal position error signal (PES) having a first frequency;

(c) filtering the PES to pass the fundamental frequency and to attenuate lower the lower and higher frequencies of the PES to provide a filtered PES;

(d) sampling the filtered PES to provide a sampled PES;

(e) substantially eliminating a plurality of harmonic frequencies of the filtered samples of the PES; and

(f) providing an analog adjustment signal for positioning the transducing head.

74. (Original) The method of claim 73, wherein sampling the filtered PES is at a second frequency.

75. (Original) The method of claim 74, wherein the second frequency is twice the first frequency.

76. (Original) The method of claim 74, further comprising down converting the filtered samples of the PES to restore the first frequency.

77. (Original) The method of claim 73, wherein the analog adjustment signal is provided for every four samples of the filtered samples of the PES.

78. (Original) The method of claim 73, wherein filtering the PES comprises analog filtering.

79. (Original) The method of claim 73, wherein attenuating harmonic frequencies of the sampled PES comprises analog filtering.

80. (Original) The method of claim 73, wherein attenuating harmonic frequencies of the sampled PES comprises digital filtering.

81. (Withdrawn) The method of claim 80, wherein the digital filtering comprises filtering through a bandpass filter.

82. (Cancelled) The method of claim 81, wherein the bandpass filter comprises a finite impulse response filter.

83. (Cancelled) The method of claim 81, wherein the bandpass filter comprises an infinite impulse response filter.

84. (Withdrawn) The method of claim 81, wherein the bandpass filter comprises a sinusoidal impulse response.

85. (Withdrawn) The method of claim 81, wherein the bandpass filter comprises a cascade filter further comprising a sinusoidal impulse filter and a simple filter.

86. (Withdrawn) The method of claim 85, wherein the simple filter is a comb filter.

87. (Withdrawn) The method of claim 86, wherein the comb filter comprises a cascade of a plurality of comb filters.

88. (Withdrawn) The method of claim 86, wherein the comb filter has an impulse response of $[1,1,1]$.

89. (Withdrawn) The method of claim 85, wherein the sinusoidal impulse filter has an impulse response substantially equal to $\left[\frac{1}{\sqrt{2}},1,\frac{1}{\sqrt{2}},0,-\frac{1}{\sqrt{2}},-1,-\frac{1}{\sqrt{2}}\right]$.

90. (Withdrawn) The method of claim 85, wherein the cascade filter has an impulse response substantially equal to

$$\left[\frac{1}{\sqrt{2}},1+\frac{1}{\sqrt{2}},1+\frac{2}{\sqrt{2}},1+\frac{1}{\sqrt{2}},0,-\left(\frac{1}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right),-\left(1+\frac{2}{\sqrt{2}}\right),-\left(1+\frac{1}{\sqrt{2}}\right)\right].$$

91. (Withdrawn) The apparatus of claim 9, wherein the bandpass filter is a cascade filter further comprising a first filter having m stages and a second filter having n stages.

92. (Withdrawn) The apparatus of claim 91, wherein n is greater than m.

93. (Withdrawn) The apparatus of claim 91 wherein m is greater than n.

94. (Withdrawn) The apparatus of claim 91, wherein m equals n.

95. (Withdrawn) The apparatus of claim 27, wherein the bandpass filtering means is a cascade filtering means further comprising a first filtering means having m stages and a second filtering means having n stages.

96. (Withdrawn) The apparatus of claim 95, wherein n is greater than m.

97. (Withdrawn) The apparatus of claim 95, wherein m is greater than n.

98. (Withdrawn) The apparatus of claim 95, wherein m equals n.

99. (Withdrawn) The system of claim 45, wherein the bandpass filter is a cascade filter further comprising a first filter having m stages and a second filter having n stages.

100. (Withdrawn) The system of claim 99, wherein n is greater than m.

101. (Withdrawn) The system of claim 99, wherein *m* is greater than *n*.

102. (Withdrawn) The system of claim 99, wherein *m* equals *n*.

103. (Withdrawn) The system of claim 63, wherein the bandpass filtering means is a cascade filtering means further comprising a first filtering means having *m* stages and a second filtering means having *n* stages.

104. (Withdrawn) The system of claim 103, wherein *n* is greater than *m*.

105. (Withdrawn) The system of claim 103, wherein *m* is greater than *n*.

106. (Withdrawn) The system of claim 103, wherein *m* equals *n*.

107. (Withdrawn) The method of claim 81, wherein the bandpass filter is a cascade filter further comprising a first filter having *m* stages and a second filter having *n* stages.

108. (Withdrawn) The method of claim 107, wherein *n* is greater than *m*.

109. (Withdrawn) The method of claim 107, wherein *m* is greater than *n*.

110. (Withdrawn) The method of claim 107, wherein *m* equals *n*.

111. (Cancelled)

112. (Previously Presented) The apparatus of claim 1, wherein said filter substantially eliminates a third harmonic frequency of the sampled PES.

113. (Cancelled)

114. (Previously Presented) The apparatus of claim 19, wherein said means for attenuating substantially eliminates a third harmonic frequency of the sampled PES.

115. (Cancelled)

116. (Previously Presented) The system of claim 37, wherein said filter substantially eliminates a third harmonic frequency of the filtered samples of the PES.

117. (Cancelled)

118. (Previously Presented) The system of claim 55, wherein said means attenuating substantially eliminates a third harmonic frequency of the sampled PES.

119. (Cancelled)

120. (Previously Presented) The method of claim 73, wherein said attenuating substantially eliminates a third harmonic frequency of the filtered samples of the PES.